1998 Cancer in Washington

Annual Report of the
Washington State Cancer Registry

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Washington State Department of
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Office of Epidemiology

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Contents

Executive Summary

This annual report of the Washington State Cancer Registry summarizes information on new cases of cancer (incidence) and death due to cancer (mortality) for Washington state residents. It represents the ongoing effort by the Department of Health, the Fred Hutchinson Cancer Research Center, the Blue Mountain Oncology Program, physicians, and cancer registrars throughout Washington. This report is also available on the Department of Health website at 198.187.0.44/WSCR or by going to the Department of Health's homepage at www.doh.wa.gov/ and selecting "health data," "interactive data," and then "WSCR-Cancer." In addition to providing the information contained in this report, the web site allows the user to obtain additional data through an interactive query system.

Cancer is a heterogeneous group of diseases characterized by uncontrolled growth and spread of abnormal cells. The various forms of cancer were responsible for 10,270 deaths among Washington residents in 1998, comprising approximately twenty-five percent of all deaths. In 1998, cancer (all types combined) was the most common cause of death among adults ages 45 to 74 years and the second leading cause across all age groups. Some form of cancer will likely strike one in three Washingtonians in their lifetime. In 1998, there were 28,382 new cases of cancer diagnosed in Washington.

The report provides information on cancer of all types combined and the 24 cancer sites most frequently diagnosed in Washington residents. The information can be used at the state and county level to identify the burden of morbidity and mortality associated with each type of cancer. This information, combined with information on cancer prevention, early detection, and treatment, is useful for program planning and policy development aimed at reducing the burden of cancer.

The five most common types of cancer reported among Washington residents during 1998 were breast, prostate, lung, colorectal, and melanoma.

1 5,227 new cases and 753 deaths from female breast cancer were reported in 1998. Breast cancer was the second most common cause of cancer mortality for women. The age-adjusted rate of new breast cancers diagnosed in Washington women in 1998 was higher than the rate for the national comparison figures. However, the rate at which Washington women die of breast cancer was similar to the rate for the US as a whole. Nationally, the incidence rates for breast cancer have been stable during the 1990s. (Ries et al., 2000) In Washington, however, breast cancer incidence rates seem to be increasing. Washington data reflect the national trend of declining death rates for breast cancer. Several factors could be contributing to the differences between Washington and the US including, differences in racial composition, reproductive patterns, stage at diagnosis, treatment modalities, and completeness of data collection. The best strategy for prevention of breast cancer mortality is early detection through screening. In 1998, approximately 70% of women in Washington met the National Cancer Institute's recommendations for mammography.

2 3,828 new cases and 576 deaths from prostate cancer were reported for 1998. It was the second leading cause of cancer death among men. Washington's age-adjusted rates were similar to the national rates for both new cases and deaths from prostate cancer. Nationally, the incidence rate of prostate cancer decreased between 1992 and 1995 and has since leveled off. (Ries et al., 2000) While Washington rates also decreased between 1992 and 1995, incidence rates increased between 1995 and 1998. It is not clear whether this increase reflects increased screening, true changes in incidence, or other factors, such as those related to data collection. Mortality from prostate cancer has been decreasing both in Washington and nationally. Experts continue to disagree on the benefits of screening for early detection of prostate cancer.

3 3,752 new cases of lung cancer were reported in 1998. 3,031 Washingtonians died of lung cancer, making it the leading cause of cancer mortality. The age-adjusted rate of new lung cancer cases in Washington was higher than the national rate, while mortality rates were similar. Differences in diagnosis, treatment, and reporting of new cases may explain the differences in rates of new lung cancers. For men, lung cancer incidence and mortality are decreasing both nationally and in Washington. (Ries et al., 2000) Unlike the national pattern of stable incidence rates of lung cancer for women between 1990 and 1997 (Ries et al., 2000), rates for Washington women increased at about 1% per year between 1992 and 1998. Part of the reason for this apparent difference may be related to Washington's demographics. Nationally, rates for white women are increasing and in Washington, approximately 89% of the population is white compared to 83% nationally. In spite of the apparent increase in incidence rates, mortality rates from lung cancer in women did not change between 1991 and 1998. Reduction in smoking remains the major focus of efforts to prevent lung cancer.

4 2,981 new cases and 970 deaths from colorectal cancer were reported in 1998. The age-adjusted rates for new cancers of the colon and rectum were similar in Washington and the US, while Washington's mortality rate was slightly lower than the national rate. Nationally, the annual incidence rate for colorectal cancer decreased between 1985 and 1997. (Ries et al., 2000) This pattern is not seen in Washington where incidence rates of colorectal cancer have stayed the same from 1992 through 1998. Mortality rates for colorectal cancer have been decreasing in both Washington and the US as a whole. Regular screening has been shown to reduce mortality. (NCI, 2000) In 1998, approximately one-third of Washington residents met the recommendations for screening. Research indicates that diets high in fat, protein, calories, alcohol and meat and low in calcium and folate may increase risk for colorectal cancer. (NCI, 2000) The American Cancer Society recommends a diet that includes at least five servings of fruit and vegetables every day and six servings of foods from other plant sources, such as grain products, rice or beans. (ACS, 2000) Regular physical activity may reduce the risk for cancer of the colon and rectum. (ACS, 2000) Smoking may increase risk. (NCI, 2000)

5 1,782 new cases and 157 deaths from melanoma of the skin were reported in 1998. The age-adjusted rate for new melanomas was higher in Washington than

in the US, while Washington's mortality rate was similar to the national rate. Several factors may contribute to this phenomenon including differences between Washington and the US as a whole in racial composition, stage at diagnosis, and completeness of reporting. Although invasive melanoma has not been increasing in Washington as it has in the US, the rate of new cases of all melanoma (invasive and in situ)[1] is increasing. The mortality rate in Washington from 1991 to 1998 remained constant, consistent with the national pattern. (Ries et al., 2000) Avoiding sunburn, especially early in life, is effective in reducing incidence of melanoma. (NCI, 2000) The American Cancer Society recommends routine examination of the skin for reducing mortality from melanoma. (ACS, 2000)

Data in this report are available for three racial groups, including Asians and Pacific Islanders, blacks and whites. The four leading causes of cancer for all three racial groups include cancers of the breast, prostate, lung, and colon and rectum. The fifth most frequently diagnosed cancer is stomach cancer for Asians and Pacific Islanders, non-Hodgkin's lymphoma for blacks, and melanoma for whites.

From 1996-1998, the breast cancer incidence rate was highest among white women, while the death rate from breast cancer was highest among black women. This phenomenon is seen throughout the United States and speaks to the need for increased outreach for screening and early treatment for black women. Black men in Washington had very high rates of prostate cancer incidence and mortality compared to the other two groups. This finding is consistent with the finding that black men in the United States have the highest rates of prostate cancer in the world. The reason for this is not known.

Although not presented in the Washington data, nationally there are large differences in cancer rates among different groups within the Asian and Pacific Islander racial classification. Length of time in the United States is related to many of these differences. This phenomenon indicates that factors related to lifestyle, such as diet, may influence rates of cancer incidence.

[1] See page 13 for a discussion of stage at diagnosis. Information on national trends is available for invasive cancer (i.e. cancer diagnosed at a local, regional or distant stage) only.

Preface

This annual report of the Washington State Cancer Registry incorporates cancer incidence data for the entire state. It represents the ongoing effort by the Department of Health, the Fred Hutchinson Cancer Research Center, the Blue Mountain Oncology Program, physicians, and cancer registrars throughout Washington. This information is presented in the hope that it will assist health care providers, public health officials, voluntary organizations, and concerned citizens in their efforts to prevent and control cancer in Washington. This report is also available on the Department of Health website at 198.187.0.44/WSCR or by going to the Department of Health's homepage at www.doh.wa.gov and selecting "health data," "interactive data," and then "WSCR-Cancer." In addition to providing the information contained in this report, the web site allows the user to obtain additional data through an interactive query system. These data may differ from earlier printed reports as cancer cases from previous years are continually added to the database.

Introduction

Cancer is a heterogeneous group of diseases characterized by uncontrolled growth and spread of abnormal cells. In 1998, there were 28,382 new cases of cancer diagnosed in Washington. The various forms of cancer were responsible for 10,270 deaths among Washington residents in 1998, comprising approximately twenty-five percent of all deaths. In 1998, cancer (all types combined) was the most common cause of death among adults ages 45 to 74 years and the second leading cause across all age groups. Some form of cancer will likely strike one in three Washingtonians in their lifetime.

Illness and death due to cancer are increasingly preventable through two types of strategies. Primary prevention strategies aim to reduce, usually through lifestyle change, the likelihood that a healthy individual will develop cancer. Alternatively, secondary prevention is accomplished by screening asymptomatic people to diagnose cancers at an early, more readily treatable stage.

This report of the Washington State Cancer Registry (WSCR) summarizes information on new cases of cancer (incidence) and deaths due to cancer (mortality) for Washington state residents and for comparative purposes, the US as a whole. The report provides information on cancer of all types combined and the 24 cancer sites most frequently diagnosed in Washington residents. This information can be used at the state and county level to identify the burden of morbidity and mortality associated with each type of cancer. This information, combined with information on cancer prevention, early detection, and treatment, is useful for program planning and policy development aimed at reducing the burden of cancer.

The Five Most Common Cancer Sites

The most common types of cancer reported among Washington residents during 1998 were breast, prostate, lung, colorectal, and melanoma.

1 5,227 new cases of female breast cancer were reported. Breast cancer was by far the most frequently diagnosed cancer among women. Responsible for 753 deaths in 1998, it was the second most common cause of cancer mortality for women. The age-adjusted rate of new breast cancers diagnosed in Washington women in 1998 was higher than the national comparison rate. However, the rate at which Washington women died of breast cancer was similar to the national rate. Several factors may contribute to this phenomenon. Washington's demographics may play a role. In both Washington and the US as a whole, white women are more likely to be diagnosed with breast cancer, but black women are more likely to die from breast cancer. US census figures for 1998 indicate that compared to the US, Washington has a larger proportion of white women (89% compared to 83% nationally) and a smaller proportion of black women (4% compared to 13% nationally). (US Census Bureau, September 1999) Rates of breast cancer are also higher for women in higher compared to lower socioeconomic groups, possibly related to reproductive patterns, such as older age at first birth among women in higher socioeconomic groups. (Shottenfeld and Fraumeni, 1996) Household income provides one measure of socioeconomic group and the US Census Bureau estimates a higher household median income in Washington compared to the US (approximately $46,000 per year in Washington for 1997-1998 compared to $38,000 in the US). (US Census Bureau, 2000) Additional research is needed to determine relative ages at first birth.

Stage at diagnosis[2] may also play a role in the finding that the rate of new breast cancer cases was higher compared to national rates, but mortality rates were similar. Washington women seem to be diagnosed at slightly earlier stages compared to women nationally based on data available through SEER*Stat Version 3.0 CD-ROM public-use file. Differences in treatment of breast cancer and completeness of data collection may also play a role.

Nationally, the rate of new cases of invasive[2,3] breast cancer increased approximately 4% per year between 1980 and 1987, but rates have leveled off since then. (Ries et al., 2000) The increase from 1980 through 1987 is consistent with increased use of mammography during that time period. (Wingo et al., 1998) The Washington data between 1992 and 1998 are not consistent with the national trend. In Washington, invasive breast cancer rates rose an average of approximately 2% per year between 1992 and 1998. During that same time period, the incidence rate for all breast cancer (i.e. invasive and in situ combined) rose approximately 3% per year.

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[2] See page 13 for a discussion of stage at diagnosis.

[3] Information on national trends is available for invasive cancer (i.e. cancer diagnosed at a local, regional and distant stages) only.

Nationally, mortality from breast cancer declined from 1990 through 1997 (Ries et al., 2000). This pattern is apparent in Washington where mortality from breast cancer has decreased approximately 3% per year from 1991 through 1998. The most likely causes for the decline in mortality rates include earlier detection of and improvements in treatment for breast cancer. (Wingo et al., 1998)

Because the cause of most breast cancer is unknown and most of the known risk factors are not easy to modify, the best strategy for prevention of breast cancer mortality is early detection and treatment. Regular breast cancer screening with mammography reduces the number of deaths from breast cancer for women between 50 and 69 years. (NCI, 2000) Experts continue to disagree on the benefits of mammography for women between 40 and 49 years and for women older than 69 years. In spite of these disagreements, the American Cancer Society recommends mammography every year for women beginning at age 40. (ACS 2000) The National Cancer Institute recommends mammography every one to two years beginning at age 40. (NCI, 2000) A clinical breast exam often accompanies mammography or routine physical examinations. The American Cancer Society recommends a clinical breast exam every year beginning at age 40. While evidence about the value of self-breast exam for reducing mortality from breast cancer is inconclusive (NCI, 2000), the American Cancer Society recommends monthly self-breast exams beginning at age 20. (ACS, 2000)

The 1998 Washington State Behavioral Risk Factor Surveillance System[4] indicates that approximately 55% of women in Washington age 40 and older reported a mammogram in the past year and approximately 71% reported a mammogram within the last two years. Approximately 62% and 77% of women age 40 and older reported a clinical breast exam in the past one and two years, respectively.

2 3,828 new cases of prostate gland cancer were reported in 1998, making prostate cancer the most commonly reported malignancy among men. It was the second leading cause of cancer death among men, killing 576 men in 1998. Washington's rates are similar to national rates for both new cases and death from prostate cancer.

Nationally, the annual rate of new cases of invasive prostate cancer decreased sharply between 1992 and 1995 (10% per year) and remained the same from 1995 through 1997. (Ries et al., 2000). The incidence rates in Washington mirrored the national pattern between 1992 and 1995 with an average decrease of 15% per year for invasive prostate cancer, and for invasive and in situ prostate cancer combined. However, between 1995 and 1998, there has been an average annual increase of 2% per year in Washington's annual incidence rate of both invasive prostate cancer, and invasive and in situ cancer combined. It is not clear whether this pattern reflects variation in screening, true changes in incidence, or other factors, such as those related to data collection. The decrease in incidence in the early 1990s may be the result of changes in

[4] The Washington Behavioral Risk Factor Surveillance System is a telephone survey of English-speaking, non-institutionalized adults.

screening practices in the late 1980s and early 1990s (i.e., the introduction of screening into an unscreened population in the late 1980s followed by a decline in screening in the 1990s). (Wingo et al., 1998) The 6% average annual decrease in the mortality rate for prostate cancer in Washington from 1994 through 1998 is similar to the national decrease of more than 4% per year from 1994 through 1997. (Ries et al., 2000)

No effective means are currently available to prevent the development of prostate cancer. The American Cancer Society recommends that health care providers offer prostate-specific antigen blood testing and digital rectal examination yearly for men age 50 and older. They further recommend that screening begin at a younger age for men at high risk, such as men with two or more first degree relatives with prostate cancer and African American men. However, prostate cancer screening has not demonstrated a clear benefit in reducing mortality and the American Cancer Society recognizes that "most major scientific and medical organizations such as the US Preventive Services Task Force, American College of Physicians, American Society of Internal Medicine, National Cancer Institute, Centers for Disease Control and Prevention, American Association of Family Practitioners, and American College of Preventive Medicine do not advocate mass screening or routine screening for prostate cancer." (ACS, 2000)

3 3,752 new cases of lung cancer were reported for 1998. 3,031 Washingtonians died of lung cancer, making it the leading cause of cancer mortality. The age-adjusted rate of new lung cancer cases in Washington was higher than the national rate. Cigarette smoking is the major cause of lung cancer. Based on the 1998 Behavioral Risk Factor Surveillance Survey[5], the proportions of people who currently smoke are about the same in Washington and the US as a whole. However, lung cancer caused by smoking may take several decades to develop and we do not know whether there was more smoking in Washington than in the US several decades ago. More complete reporting of new cases in Washington compared to the US may also explain the elevated rate in Washington. The mortality rates were similar in Washington and the US as a whole.

For men, lung cancer incidence and mortality are decreasing both nationally and in Washington. For women, the changes over time are more complex. Nationally, the annual rate of new cases of invasive[6] lung cancer for women did not change between 1990 and 1997 (Ries et al., 2000). In contrast, between 1992 and 1998, rates for Washington women increased at about 1% per year for both invasive lung cancer, and for invasive and in situ combined. One reason for the apparent discrepancy between trends for lung cancer in women nationally and in Washington may be related to Washington's racial composition. Nationally, invasive lung cancer rates among white women rose at almost 1% per year between 1988 and 1997. (Ries et al. 2000) In Washington, 89% of the population is white compared to 83% nationally. (US Census Bureau, September

[5] The Behavioral Risk Factor Surveillance System (BRFSS) is a telephone survey of non-institutionalized adults. It is administered in all 50 states, the District of Columbia and Puerto Rico. The Washington BRFSS includes English-speaking people only.

[6] See page 13 for a discussion of stage at diagnosis.

1999) Nationally, mortality for lung cancer in women increased approximately 1% per year from 1990 through 1997. (Ries et al. 2000) In Washington, mortality rates for women have been stable between 1991 and 1998.
Cigarette smoking is by far the most important cause of lung cancer. Nationally, approximately 90% of male and 72% of female lung cancer deaths are attributed to smoking. (CDC, 1997) Although a new x-ray technique has been successful in detecting early lung cancer in smokers and former smokers, it is not known whether this early detection will result in decreased mortality. Currently, neither the American Cancer Society nor the National Cancer Institute recommends routine screening for lung cancer. (ACS, 2000; NCI, 2000) Reduction in smoking remains the major focus of efforts to prevent lung cancer.

4 2,981 new cases of colon and rectal cancer were reported in 1998. Colorectal cancer was the state's second leading cause of cancer death, resulting in the loss of 970 lives in 1998. The age-adjusted rates for new cancers of the colon and rectum were similar in Washington and the US as a whole, while Washington's mortality rate was slightly lower than the national rate. This is somewhat surprising in that Washington residents seem to be being diagnosed at later stages[7] compared to people in the US as a whole and survival is worse with a later stage at diagnosis. In Washington, 35% of new cancers of the colon and rectum were diagnosed relatively early (in situ or local stages) and 43% were diagnosed at a regional stage compared to 42% and 34%, respectively, in the national comparison data available in the SEER*Stat version 3.0 CD-ROM public-use file.

Nationally, the annual incidence rate for invasive colorectal cancer decreased between 1985 and 1997. (Ries et al., 2000) This pattern is not seen in Washington where incidence rates of colorectal cancer (both invasive, and in situ and invasive combined) have stayed the same from 1992 through 1998. The national mortality rate has been decreasing since the 1970s for men and since the late 1940s for women. (Wingo et al., 1999) In Washington, mortality rates from colorectal cancer have decreased approximately 2.5% per year from 1991 through 1998. Changes in screening, treatment, and lifestyle may be contributing to this decrease. (Wingo et al., 1998)

The National Cancer Institute concludes that screening of the stool for invisible amounts of blood (fecal occult blood test) every year or every two years beginning at age 50 reduces death from cancer of the colon and rectum. The National Cancer Institute also concludes that regular visual examination of the lower bowel (sigmoidoscopy) beginning at age 50 may reduce mortality from colorectal cancer. The National Cancer Institute does not believe that there is sufficient evidence to determine how often people should have sigmoidoscopies. (NCI, 2000) The American Cancer Society recommends several screening options. The option most similar to that of the National Cancer Institute is yearly fecal occult blood tests and sigmoidoscopy every five years beginning at age 50 for the general population. The American Cancer Society recommends more frequent screening, beginning at earlier ages for those who may be more susceptible to colorectal cancer, such as people with a history of colorectal

[7] See page 13 for a discussion of stage at diagnosis.

cancer in their family. (ACS, 2000)

The Washington State Behavioral Risk Factor Surveillance System[8] indicates that in 1999, approximately 25% of Washingtonians age 50 and older reported a fecal occult blood test in the past year and approximately 35% reported a test within the last two years. Approximately 36% of Washingtonians age 50 and older reported a sigmoidoscopy within the past five years.

The National Cancer Institute states that colorectal cancer most likely results from complex interactions between inherited susceptibility and environmental factors. (NCI, 2000) Research indicates that diets high in fat, protein, calories, alcohol and meat and low in calcium and folate may increase risk for colorectal cancer. (NCI, 2000) The American Cancer Society recommends a diet that includes at least five servings of fruit and vegetables every day and six servings of foods from other plant sources, such as grain products, rice or beans. (ACS, 2000) Regular physical activity may reduce risk for cancer of the colon and rectum. (ACS, 2000) Smoking may increase risk. (NCI, 2000)

5 1,782 new cases of melanoma of the skin were reported in 1998. Melanoma accounted for 157 deaths in Washington residents. The age-adjusted rate for new melanomas was higher in Washington than in the US as a whole, while Washington's mortality rate was similar to the national rate. Several factors may contribute to this phenomenon. Rates are much higher in white people than in people of other races. In Washington, 89% of the population is white compared to 83% nationally. (US Census Bureau, September 1999) Additionally, people in Washington seem to be being diagnosed when the disease is at an early stage[9] and early diagnosis improves survival. Approximately 91% of Washingtonians with melanoma were diagnosed while the melanoma was in situ or local compared to 87% in the national data available through SEER*Stat version 3.0 CD-ROM public-use file. Finally, the reporting of new cases of melanoma may be more complete in Washington than nationally.

Nationally, the annual incidence rate of invasive melanoma has been increasing since the 1970s. (Ries et al., 2000) This pattern is not reflected in Washington data where the rate of new cases of invasive disease remained the same between 1992 and 1998. However, the vast majority of melanoma is diagnosed at an early stage and there has been an increase in the rate of new cases of all melanoma (in situ and invasive) in Washington residents of approximately 3% per year between 1992 and 1998. The mortality rate in Washington from 1991 to 1998 has remained constant, consistent with the national pattern. (Ries et al., 2000)

There is evidence that avoiding sunburns, especially during childhood and adolescence, may be effective in preventing melanoma. (NCI, 2000) Since some studies suggest that sunscreens do not protect against melanoma (they do protect against other types of skin cancer), avoiding exposure to the sun through

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[8] The Washington Behavioral Risk Factor Surveillance System is a telephone survey of English-speaking, non-institutionalized adults. Questions on colorectal cancer screening are asked every other year.

[9] See page 13 for a discussion of stage at diagnosis.

other methods, such as wearing protective clothing, may be important in decreasing risk for melanoma. (NCI, 2000; ACS, 2000) Although the National Cancer Institute concludes that there is insufficient evidence that routine examination of the skin is effective in reducing mortality from melanoma, the Institute notes several instances where vigorous public and professional education programs resulted in detection of melanoma at earlier stages of disease and improved survival. (NCI, 2000)

The American Cancer Society recommends skin examination by a doctor every three years for people 20 to 40 years old and every year for people older than 40 years. The American Cancer Society also recommends monthly self-examination and provides guidelines for recognizing signs of the disease. These include moles that are asymmetrical (that is, one side does not match the other), have irregular borders (that is, the edges of the mole are ragged or notched); have more than one color or shade; or are larger than about ¼ inch across. The guidelines can be easily remembered as A (**a**symmetrical), B (irregular **b**orders), C (more than one **c**olor) and D (**d**iameter of more than ¼ inch). A change in the in size, shape or color of a mole may also be a sign of melanoma. (ACS, 2000)

Washington State Cancer Registry

Background

In 1990, RCW 70.54.230 made cancer a reportable condition in Washington and mandated the Department of Health to establish a statewide cancer registry program. Under this mandate, the Department established the Washington State Cancer Registry (WSCR) in 1991. The registry is dedicated to fulfillment of the legislative intent "...to establish a system to accurately monitor the incidence of cancer in the state of Washington for the purposes of understanding, controlling, and reducing the occurrence of cancer in this state." Since 1994, funding for WSCR has been provided, in part, through the Centers for Disease Control and Prevention's National Program of Central Cancer Registries. This program is designed to standardize data collection and provide information for cancer prevention and control programs at the local, state, and national levels.

Data Collection

Cancer cases are collected through a combination of contracts with two regional cancer registries and cases from independent reporting facilities (such as hospitals and clinics) with in-house cancer registry programs. The contractors and reporting facilities are responsible for case-finding, abstracting information on cancer from medical sources, and reporting cases to the statewide registry. The Cancer Surveillance System (CSS) of the Fred Hutchinson Cancer Research Center provides data on cancer cases from 13 counties in Western Washington, covering the majority of the state's population including the largest urban center of Seattle. CSS has been in operation since 1974 as a participant in the Surveillance Epidemiology and End-Results (SEER) Program of the National Cancer Institute.

The remainder of the state is covered by reporting facilities with in-house cancer registry programs and the Walla Walla-based Blue Mountain Oncology Program

(BMOP). BMOP is a consortium of 14 hospital-based cancer registries and provides the state with data from hospitals in the Walla Walla, Tri-Cities and Spokane areas. In addition, under contract to the Department of Health, BMOP provides staff to collect cases at facilities that do not have in-house cancer registries. WSCR also conducts regular data exchanges with state cancer registries in Oregon and Idaho to gather data on Washington residents traveling across state lines for cancer diagnosis and treatment.

Cancer cases are identified through reports from hospitals, pathology laboratories, radiation oncology centers, ambulatory surgical centers, cancer treatment centers, and physicians. Once the case is identified, an abstract of cancer information is completed within 6 months and quality assurance activities are carried out by the contractors and reporting facilities. Data files are transmitted from the contractors and reporting facilities to the state on a regular basis. WSCR is responsible for merging the data and finalizing the statewide data set, overall data quality assurance in accordance with national standards, and dissemination of cancer information to assist with cancer prevention and control efforts statewide.

The cancer reporting rules (246-430 WAC) define reportable cancers as "any malignant neoplasm, with the exception of basal and squamous cell carcinoma of the skin". Also specifically included are: 1) basal and squamous cell carcinoma of the external genital organs (vulva, labia, clitoris, prepuce, penis, anus, scrotum); 2) all brain tumors; 3) ovarian tumors of borderline or low malignant potential; and 4) cancer in situ, except cancer in situ of the uterine cervix. The legally required data for cancer reporting include patient demographics (such as age and sex) and medical information (such as type of cancer and date and stage at diagnosis) for all newly diagnosed cancers. Copies of Washington's cancer reporting legislation and regulations are available on request.

Report Contents

The first set of data in this report summarizes incidence and mortality for all cancers combined and for the 24 cancer sites most frequently diagnosed in Washington residents. A second data section summarizes cancer incidence and mortality by race. Each of these sections begins by showing the distribution of diagnoses and deaths for the most common cancer sites. These charts are followed by information on each of the selected malignancies. Finally, appendices include technical notes and sources of information on the epidemiology and prevention of cancer.

The primary focus of this report is on cases newly diagnosed between January 1, 1998 and December 31, 1998. This information covers the entire state and also includes new cases of cancer among Washington residents diagnosed in Oregon and Idaho. Mortality statistics include deaths among Washington residents that occurred in 1998 where the underlying cause of death was cancer. The cancer may have been diagnosed before 1998.

The following material briefly describes the tables, graphs and charts in this report; the statistical methods used to produce each table, graph or chart; and special considerations for interpreting the data.

Tables, Charts and Graphs

Data Definitions and Sources

The Washington State Cancer Registry provides the number of new cases (incidence) of cancer as described above. Based on estimates of the expected number of cancer cases, the registry includes more than 95% of cases. Each cancer is coded to an International Classification of Diseases Oncology (ICD-O) code. The data definition provides the ICD-O codes used in each section. We have used definitions that are consistent with those used by the National Cancer Institute's SEER program.

The Washington State Department of Health, Center for Health Statistics provides information from death certificates on the number and causes of death. According to the National Center for Health Statistics, more than 99% of all deaths occurring in the United States are registered in the death certificate system. Accuracy of reporting specific causes of death varies since classification of disease conditions is a medical-legal opinion subject to the best information available to the physician, medical examiner, or coroner certifying the cause of death. We obtained the number of cancer deaths from the Vital Registration System Annual Statistical Files, Washington State Deaths 1980-1998 CD-ROM issued August 1999.

The underlying cause of death is coded to an International Classification of Diseases, 9th Revision (ICD-9) code. The data definition provides the ICD-9 codes used in each section. We have used definitions that are consistent with those used by the SEER program. **For some cancer sites, including colorectal, liver, breast, and multiple myeloma, the SEER coding differs from the National Center for Health Statistics coding which may be used in other Department of Health reports.** Therefore, before comparing information from different reports, one must be sure that the definitions are consistent.

We obtained population estimates necessary for the calculation of rates from the Washington State Department of Social and Health Services, Research and Data Analysis. These estimates, called Washington State adjusted population estimates, were released in April 1999 and are based on estimates by Claritas, Inc. and the Washington State Office of Financial Management.

Incidence and Mortality Summary

These tables provide the number of new cases of cancer and the number of cancer deaths for Washington State residents in 1998. Since the numbers of new cases and deaths depend, in part, on the size of the population, we converted numbers to rates (e.g., the number of cases per 100,000 people) so that they may be compared among different regions or populations. For diseases, such as cancer, where incidence varies with age, the rates are usually age-adjusted to minimize the effect of different age distributions when comparing two geographic regions or populations.

Following National Cancer Institute guidelines, we have adjusted rates to the 1970 US standard population. Since many organizations are changing to the 2000 US standard population, we have also provided rates adjusted to the 2000 US standard population. **When making comparisons, one must be careful to compare age-adjusted rates that are adjusted to the same standard population.** Age-

adjusted rates should not be compared to rates which are not age-adjusted (i.e., crude rates). Detail on our age-adjustment method is provided in Appendix A.

The final row of the incidence tables provides age-adjusted incidence rates from the eleven National Cancer Institute's SEER regions. These rates are from SEER*Stat version 3.0 CD-ROM public-use file containing data from 1973-1997, issued April 2000. The final row of the mortality tables provides age-adjusted mortality rates for the United States. The US mortality data were obtained from the SEER CanQues program (http://www-seer.ims.nci.nih.gov/ScientificSystems/Canques1973_1997/). The SEER programs do not include data for 1998. Since cancer incidence and mortality rates do not change rapidly, we have provided 1997 national data for comparison.

Stage at Diagnosis

Stage at diagnosis refers to how far a cancer has spread from its site of origin when it is diagnosed. The stages, in order of increasing spread, are in situ, local, regional and distant. Cancers staged as local, regional, or distant are referred to as invasive. The reader should note that many publications of the National Cancer Institute and the Centers for Disease Control and Prevention report rates of invasive cancer only. Thus, caution must be exercised when comparing incidence rates contained in different reports.

The WSCR data contain the stage of disease at diagnosis coded according to the SEER guidelines.

In Situ	A tumor that fulfills all microscopic criteria for malignancy, but does not invade or penetrate surrounding tissue.
Localized	A tumor that is invasive but remains restricted to the organ of origin.
Regional	A tumor that has spread by direct extension to immediately adjacent organs or tissues and/or metastasized (spread through the blood stream) to regional lymph nodes, but appears to have spread no further.
Distant	A tumor that has spread by direct extension beyond the immediately adjacent organs or tissues, and/or metastasized to distant lymph nodes or other distant tissues.
Unstaged	Insufficient information available to determine the stage of disease at diagnosis.

We have provided the frequency distribution of cases according to their stage at diagnosis.

For most cancers, diagnosis at an early stage (in situ or local) results in improved survival. One standard measure of survival is the five-year survival rate that estimates the proportion of individuals with a given cancer who are living five years

after diagnosis. Due to the relative newness of WSCR, we have not developed five-year survival rates for Washington state residents. However, we have provided the SEER five-year survival rate for each cancer. These statistics were obtained from SEER*Stat version 3.0 CD-ROM public-use file containing data from 1973-1997, issued in April 2000. This data file provides survival rates by stage of disease at diagnosis. The national five-year relative survival rates are calculated for cancer cases diagnosed between 1992 and 1996, based on follow-up of patients through 1997. The National Cancer Institute defines the relative five-year survival rate as the likelihood that a patient will not die from causes associated with their cancer within five years. The SEER*Stat program calculates this rate using a procedure described by Ederer, Axtell, and Cutler (1961) whereby the observed survival rate is adjusted for expected mortality. It is always larger than the observed survival rate. (Ries et al., 1999)

Age-Specific Incidence Rates

Age-specific rates show the variation in cancer incidence by age group for males, females, and the total population. The age-specific rates are the average rates for 1996-1998. Combining three years of data reduces the potential that annual changes in small numbers for some age and sex groups will result in fluctuations that are difficult to interpret.

Incidence and Mortality Rate Trends

These charts provide incidence and mortality rates for several years for Washington residents per 100,000 population, age-adjusted to the US 1970 standard population. (See “Incidence and Mortality Summary” for a discussion of age-adjusted rates.) These tables show both changes in rates over time and the relationship between cancer incidence and mortality.

Incidence and Mortality Rates by County

We have presented the average annual age-adjusted cancer incidence and mortality rates for Washington residents per 100,000 population by county. (See “Incidence and Mortality Summary” for a discussion of age-adjusted rates.) Because of the small size of many counties and the relative rarity of some types of cancer, the incidence and mortality rates based on one year of data are not stable (i.e., there is some random fluctuation in rates from year to year). Therefore, for county rates, we have combined three years of data (1996-1998) to compute average annual age-adjusted rates for the three-year period.

The state rates and 95% confidence intervals are included for comparison purposes. While the incidence and death statistics in this report are not subject to sampling error, they may be affected by random variation. The confidence interval is used to describe the range of that variation.

Generally, when the confidence interval for the area of interest does not overlap with the confidence interval for the comparison area, we say that the two areas are statistically significantly different, i.e., the difference between the two rates is more than that expected by random variation or chance. However, if we are making many comparisons, we may still find statistically significant differences just by chance. In

fact, with a 95% confidence interval, we expect that 5% of the comparisons will be statistically significant by chance. Thus, with 39 counties and 24 cancer sites, we might see as many as 45 instances where the rate for a county is statistically significantly different from the state rate just by chance.

Even with a three-year average, rates may fluctuate widely when there are a small number of cases. Therefore, we omit the rate and confidence intervals when there are fewer than five cases for the three-year period. Details of our methods for calculating confidence intervals are in Appendix A.

County Data Tables

We have included tables with county data following the sections on the 24 cancer sites. Each table provides the average annual number of new cases and the average annual number of deaths for 1996 - 1998. These numbers are the total number of new cancers or the total number of deaths for the three-year period divided by three. The table also includes incidence and mortality rates with the 95% confidence interval, age-adjusted to both the 1970 and 2000 US standard populations. (See “Incidence and Mortality Summary” for a discussion of age-adjusted rates. See “Incidence and Mortality Rates by County” for a discussion of confidence intervals.) Age-adjustment using these standards is included so that the rates are comparable to those from the National Cancer Institute, which adjusts to the 1970 US standard population and to those from other groups that might age-adjust to the 2000 US standard population. However, caution must be used in making comparisons among different sources, since coding of cancer sites varies. In particular, we have noted that the National Cancer Institute and the National Center for Health Statistics use different codes for colorectal, liver, breast, and multiple myeloma.

Cancer by Race

Background

The cancer reporting rules require that the race and ethnicity of each case be included in the data provided to WSCR. Following national standards of the US Office of Budget and Management, races include American Indian and Alaska Native, Asian and Pacific Islander (API), African-American or black, and Caucasian or white. Ethnicity is Hispanic or non-Hispanic.

In interpreting data by racial and ethnic group, it is important to remember that the standard racial and ethnic groupings are broad categories that for the most part do not reflect a homogenous group of people. Important differences exist within groups based on genetic predisposition and cultural heterogeneity. Some of the cultural heterogeneity occurs because people of diverse cultural backgrounds are classified as one racial group. Other reasons for heterogeneity within one racial or ethnic group that may be particularly important in Washington include differences in length of time in the United States and regional differences within the United States that are reflected in people who move to Washington.

In spite of the heterogeneity among people in one racial or ethnic group, reporting cancer incidence by racial and ethnic group is desirable because different groups

have different patterns of cancer incidence and mortality. Many people and organizations involved in reducing incidence and death from cancer provide outreach to specific racial and ethnic groups and so knowledge of what may be most important for those groups will help them in their work. Additionally, the federal Healthy People 2010 initiative outlines the goal of reducing health disparities among racial and ethnic groups. The Washington State Department of Health has adopted this goal as a priority. To determine whether disparities exist, we must first provide data by racial and ethnic group.

The reasons for differences by racial and ethnic group are often not clear. Some of these differences seem to be related to biological differences among racial groups. For example, as a group, whites have skin types that are more likely to develop melanoma compared to people of other races. Many of the differences seem to be related to lifestyle. For example, diet may play a role in the finding that Asians in the United States have higher rates of prostate cancer than Asians living in Asia. Differences in access to and acceptance of medical care, including screening for early detection and treatment and access to quality medical care, also seem to play a role. Differences in some of these factors may reflect other differences by racial and ethnic group, such as differences in employment rates, health insurance coverage and rates of poverty. In these instances, racial and ethnic groupings are, at best, poor proxy measures of more important factors for which we do not have information.

A study linking Indian Health Services data to WSCR revealed that American Indians are often reported as white and are, therefore, underreported in WSCR. (Sugarman et al., 1996) For people who died between 1992 and 1996, we compared reporting of race and ethnicity on the death certificate and in WSCR. Overall, racial classification agreed in the two sources for 98.6% of the records. However, there were marked differences by race. Approximately 99% of those recorded as white, 97% of those recorded as black, and 94% of those recorded as Asian and Pacific Islander on the death certificate were recorded as such in WSCR. However, only approximately 70% of people recorded as American Indians and Native Alaskans on the death certificate were recorded as such in WSCR. Only 74.6% of people reported as Hispanics on the death certificate were recorded as such in WSCR.

Based on this analysis, we have concluded that the data in WSCR are of sufficient quality to report data by race for Asians and Pacific Islanders (API), blacks and whites. According to the 1990 US Census, APIs, blacks, and whites make up 4%, 3% and 89% of Washington's total population, respectively. The National Cancer Institute provides information separately for people of Chinese, Filipino, Hawaiian, Japanese, Korean and Vietnamese heritages. However, the current quality of data in WSCR do not allow this level of reporting. Therefore, following the US Office of Management and Budget recommendations, we have included these groups under the general classification of API. The API group includes the groups mentioned above, plus people from the Indian subcontinent and other people from all areas of southeast Asia and the Pacific Islands. According to 1990 US Census Bureau information, the largest API groups in Washington are Filipino (21% of all APIs), Japanese (16%), Chinese (16%), Korean (14%), and Vietnamese (9%).

The data in WSCR are not of sufficient quality to report information for American Indians and Hispanics. We will continue to try to improve reporting for American Indians and Hispanics with the goal of including this information in subsequent WSCR reports.

Leading Causes of Cancer by Race

We have included information on all cancer sites combined and 16 specific sites that include the 10 cancer sites most frequently diagnosed among APIs, blacks and whites. Cancer of the breast, prostate, lung, and colon and rectum are among the four most frequently diagnosed cancer sites for all three races. The fifth most commonly diagnosed cancer is stomach for APIs, non-Hodgkin's lymphoma for blacks and melanoma for whites. General information on the four most commonly diagnosed sites and melanoma is available beginning on page 5.

Breast Cancer (female)

From 1996 - 1998, breast cancer was the most commonly diagnosed cancer among APIs and whites in Washington. It was the second most commonly diagnosed cancer among blacks. White women had the highest rates of breast cancer, followed by black and API women. Although from somewhat different time periods, this pattern is consistent with national figures for 1988 - 1992. Nationally, there were large differences within the API group. For the five largest API groups in Washington, national data showed all of these groups having rates of breast cancer that were lower than those of blacks and whites. However, women of Japanese and Filipino heritages had relatively high rates and women of Korean and Vietnamese heritages had relatively low rates. Women of Chinese heritage had rates in the middle. (Miller et al., 1996)

Nationally from 1988 -1992, black women had a lower incidence rate of invasive breast cancer and a higher mortality rate compared to whites. (Miller et al., 1996) This pattern is seen in the 1996 - 1998 Washington data and speaks to the need for outreach to black women in Washington to improve rates of early detection and treatment.

Prostate Cancer

From 1996 -1998, prostate cancer was the most frequently diagnosed cancer among blacks in Washington. It was the third most commonly diagnosed cancer among whites and the fourth among APIs. Black men in Washington had the highest rates of both incidence and mortality from prostate cancer, followed by whites and APIs. Miller et al. (1996) note that blacks in the United States have the highest rates of prostate cancer in the world. They also note that part of the relatively low rate among APIs as a group is related to recent immigration of people from Asia, where rates of prostate cancer are much lower than in the United States. For the five largest API groups in Washington, national data from 1988 - 1992 indicated that men of Japanese heritage had the highest rates of prostate cancer, followed by men of Filipino, Chinese, Vietnamese and Korean heritages. (Miller et al., 1996)

Lung and Bronchus

From 1996 - 1998, lung cancer was the third most commonly diagnosed cancer among blacks and APIs in Washington. It was the second most commonly diagnosed cancer among whites. It was the leading cause of cancer death for all three groups. Overall, rates of lung cancer were highest for blacks, followed by whites and APIs.

For all three groups, there were large differences in incidence between men and women, with rates for men being between approximately 1.5 and twice that of women. These differences most likely reflect historical smoking patterns. The relative rates among the three groups in Washington reflect the relative rates for men. Rates of lung cancer are similar among black and white women. These rates are approximately two times the rate among API women. The same patterns are seen in the 1988 - 1992 national data. (Miller et al., 1996)

The 1988 - 1992 national data for the five largest API groups in Washington showed that men of Vietnamese heritage had the highest rates of lung cancer and men of Japanese heritage had the lowest. The rates for men of Filipino, Chinese and Korean heritages were all about the same and these rates fell between those for men of Japanese and Vietnamese heritage. Rates for all these groups were lower than rates for whites and blacks. Like men, national data for women showed that women of Vietnamese heritage had the highest rates of lung cancer among the five largest API groups in Washington. However, unlike men, the national data for women showed relatively low rates for women of Filipino, Japanese and Korean heritages. (Miller et al., 1996)

Colon and Rectum

From 1996 - 1998, colorectal cancer was the second leading cause of cancer among APIs in Washington and the fourth leading cause for blacks and whites. However, similar to the national pattern (Miller et al., 1996), blacks in Washington had the highest incidence and death from colorectal, followed by whites and APIs.

Nationally, variation within the API group is important. From 1988 - 1992, men of Japanese heritage had a higher incidence rate of colorectal cancer compared to black men. The incidence rate of colorectal cancer for women of Japanese heritage was between that of black and white women. People of Filipino, Korean and Vietnamese heritages had the lowest rates. The rate for people of Chinese heritage was lower than rates for whites and Japanese, but higher than rates for the other API groups. (Miller et al., 1996) Some of these differences within the API group may reflect the proportion of people in the different groups who are born outside of the United States. According to Miller et al. (1996), “Migrants to the United States (from Japan and other countries where rates of colon and rectum cancer are lower than in the U.S.) have higher rates than do those who remain in their native countries. Studies have shown that first and second generation American offspring from these migrant groups develop these cancers at rates reaching or exceeding those of the United States white population.” (p.42)

Stomach

From 1996 - 1998, stomach cancer was the fifth leading cause of cancer and the fourth leading cause of cancer deaths among APIs in Washington. It was the 10th

leading cause of cancer among blacks in Washington and the 16th among whites. The incidence and mortality rates reflect this distribution with highest rates for APIs, followed by blacks and whites. These patterns are similar to national patterns from 1988 - 1992. (Miller et al., 1996)

National data for 1988 - 1992 showed large differences in the incidence of stomach cancer within the API group. Additionally, the ratio of male to female cases differed for different API groups. For people of Vietnamese and Filipino heritages, incidence rates for men and women are similar. For people of Chinese, Japanese and Korean heritages, rates for men are approximately twice those for women. For men, people of Korean heritage had the highest incidence rates between 1988 and 1992. For women, rates were highest among people of Vietnamese heritage. Rates were lowest among both men and women of Filipino heritage. (Miller et al., 1996)

Infection with helicobacter pylori has been associated with increased risk for stomach cancer. However, neither the American Cancer Society nor the National Cancer Institute conclude that causality has been firmly established. (ACS, 2000; NCI, 2000) Additionally, the National Cancer Institute believes that there is insufficient evidence to conclude that eradication of helicobacter pylori decreases risk for stomach cancer. (NCI, 2000) Diets high in pickled, smoked and salted foods and low in fresh fruits and vegetables are also associated with increased risk of stomach cancer. Conversely, eating diets high in whole grain products, fresh fruits and vegetables seems to lower the risk of stomach cancer. However, the specific dietary components influencing the risk of developing stomach cancer have not been clearly delineated. (ACS, 2000; NCI, 2000)

In Japan, where stomach cancer is about five times more common than in the United States, improved survival after a diagnosis of stomach cancer has been attributed to mass screening programs for early detection and treatment. While it is not clear that this approach is useful in the United States, some populations at increased risk for stomach cancer may benefit from screening. These populations include immigrants from countries with high rates of stomach cancer. Among the groups covered in this report, the National Cancer Institute specifically notes high rates of stomach cancer in Japan, China and Korea. (NCI, 2000)

Non-Hodgkin's Lymphoma

From 1996-1998, non-Hodgkin's lymphoma (NHL) was the fifth leading cause of cancer among blacks and the seventh leading cause among APIs and whites in Washington. Nationally from 1988 - 1992, whites had higher incidence and mortality rates of NHL than blacks. (Miller et al., 1996) In Washington, relatively few black people develop NHL, even though it is the fifth leading cause of cancer among blacks in Washington. With small numbers the rates become imprecise, making it difficult to determine whether rates for whites are higher than those for blacks.

APIs in Washington have a lower incidence rate of NHL compared to whites. Nationally, from 1988 - 1992 there were differences within the API group. People of Korean heritage had relatively low rates compared to people of Vietnamese, Japanese, Chinese and Filipino heritages. (Miller et al., 1996)

Factors associated with increased risk of NHL include exposure to ionizing radiation; chemicals in the environment, such as benzene and some types of pesticides; chemotherapy or radiation treatment for other forms of cancer; and some infectious

agents, such as the human immunodeficiency virus (HIV) which causes AIDS. However, most people with NHL do not have any of these risk factors and the cause of the disease is unknown. (ACS, 2000).

Melanoma

From 1995 - 1997 melanoma was the fifth leading cause of cancer among whites in Washington. While APIs and blacks are diagnosed with melanoma at much lower rates than whites, people of all races may get melanoma and so it is important for everyone to recognize the signs of this disease. More detail on melanoma is presented on page 9 of this report.

Tables, Charts and Graphs by Site for Asians and Pacific Islanders, Blacks, and Whites

This portion of the report contains data on all cancers combined and on the 10 most frequently diagnosed cancer sites for APIs, blacks and whites, resulting in 16 separate sites. The number of API and black residents in Washington is relatively small and the some types of cancer are not very common. With relatively small numbers, there is often year to year variation in rates that appears to be random. To minimize the impact of this variation, we have combined data for 1996 - 1998 for this section of the report. Additional information on data sources, definitions, and technical notes, applicable to race-specific tables, charts and graphs included in this report, is provided on pages 12-15. Special attention should be given to the technical notes for county data, which cover many points related to small numbers and confidence intervals.

As in the previous tables, we have not calculated rates and confidence intervals if there are fewer than five cancers for the three-year period. Additionally, we have not presented stage at diagnosis information when there are fewer than 15 cases for the three-year period.

What's Missing

Information on Prevention, Early Detection, and Treatment

Illness and death due to cancer are increasingly preventable through the application of growing knowledge about the causes of cancer, improved screening, and early diagnosis techniques, and more effective treatment. Extensive information on prevention through changing modifiable risk factors, early detection through routine screening, and preferred treatment modalities is available. We have not attempted to reproduce this information in detail. However, a brief summary of the most important public health aspects of cancer prevention and control follows in the paragraphs below. We have provided a resource list in Appendix B for those interested in more detail.

Screening for early detection has a clear role in reducing the disease burden due to cancer of the female breast, the uterine cervix, and colorectal cancer (NCI, 2000). There is also evidence that routine examination of the skin may be effective in reducing mortality from melanoma. (NCI, 2000) Inspection of the oral cavity by dentists and physicians may help identify oral cancers at earlier, more treatable

stages, but there is not current evidence that routine screening results in decreased mortality from oral cancer. (NCI, 2000)

Major reductions in cancer rates and in an individual's likelihood of developing cancer are achievable through primary prevention strategies.

- The elimination of tobacco use would markedly reduce the incidence of lung cancer and reduce the incidences of cancer of the oral cavity and pharynx, esophagus, bladder, kidney, pancreas, colon, and rectum. (Schottenfeld and Fraumeni, 1996; NCI, 2000) Cancers of other sites, especially those of squamous cells, such as squamous cell cancer of the uterine cervix, may also be reduced by elimination of tobacco use. (Schottenfeld and Fraumeni, 1996).
- A diet low in fat, including five or more servings per day of fruits and vegetables, is likely to reduce the risk for cancer of the colon and rectum, oral cavity, esophagus, and stomach (Schottenfeld and Fraumeni, 1996) and possibly reduce the risk of breast cancer (NCI, 1999). Additional studies have shown beneficial effects of a diet rich in fruits and vegetables for prevention of cancer at other sites, such as uterine cervix, ovary, endometrium, lung, larynx, and other organs, but the scientific literature for these sites is not as extensive and/or consistent as for the sites previously listed. (Schottenfeld and Fraumeni, 1996)
- Regular, moderate exercise has also been shown to have some benefit in the prevention of cancer at a number of sites, such as colorectal and breast (NCI, 2000).

The overall health benefit of these habits, and their lack of countervailing risk, makes them wise choices for cancer prevention. Health care providers, public health agencies, and voluntary organizations can provide the education that helps people make healthy choices.

While individual behavior plays an important role in cancer prevention, governmental and other societal entities have key roles as well. Policies and regulations that, for example, ban cigarette smoking, reduce youth access to tobacco, assure delivery of health services and control occupational exposures are important for preventing and controlling cancer.

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Appendices

Appendix A: Technical Notes

Appendix B: Sources of Additional Information

Appendix C: Advisory Council Members

Appendix D: Washington State Cancer Registry Contacts

Appendix A: Technical Notes

Age-Adjustment

Age-adjusted incidence rates were developed using the direct method. They were standardized to the age distribution of the United States 1970 and 2000 populations. Following the age-adjustment procedures used by the National Cancer Institute, which uses the US 1970 standard population for age-adjustment, we used five year age groups in calculating age-adjusted rates with the 1970 US standard population. Five year age groups were also used in calculating age-adjusted rates with the 2000 US standard population. The age distributions of the US standard populations are shown below.

US Standard Population Proportions

age group	1970 proportion	2000 proportion
0 - 4	0.0844	0.0691
5 - 9	0.0982	0.0725
10 - 14	0.1023	0.0730
15 - 19	0.0938	0.0722
20 - 24	0.0806	0.0665
25 - 29	0.0663	0.0645
30 - 34	0.0562	0.0710
35 - 39	0.0547	0.0808
40 - 44	0.0590	0.0819
45 - 49	0.0596	0.0721
50 - 54	0.0546	0.0627
55 - 59	0.0491	0.0485
60 - 64	0.0424	0.0388
65 - 69	0.0344	0.0343
70 - 74	0.0268	0.0318
75 - 79	0.0189	0.0270
80 - 84	0.0112	0.0178
85+	0.0074	0.0155

Direct method of age adjustment

Multiply the age-specific rates in the target population by the age distribution of the standard population.

$$\hat{R} = \sum_{i=1}^{m} s_i(d_i/P_i) = \sum_{i=1}^{m} w_i d_i$$

Where m is the number of age groups, d_i is the number of deaths in age group i, P_i is the population in age group i, and s_i is the proportion of the standard population in age group i. This is a weighted sum of Poisson random variables, with the weights being (s_i/P_i).

Confidence Intervals

Confidence intervals for the age-adjusted rates were calculated with a method based on the gamma distribution (Fay and Feuer, 1997). This method produces valid confidence intervals even when the number of cases is very small. When the number of cases is large the confidence intervals produced with the gamma method are equivalent to those produced with the more traditional methods, as described by Chiang (1961) and Brillinger (1986). The formulas for computing the confidence intervals are given below. Although the derivation of this method is based on the gamma distribution, the relationship between the gamma and Chi-squared distributions allows the formulas to be expressed in terms of quantiles of the Chi-squared distribution, which can be more convenient for computation.

$$\text{Lower Limit} = \frac{v}{2y}\left(\chi^2\right)^{-1}_{\frac{2y^2}{v}}(\alpha/2)$$

$$\text{Upper Limit} = \frac{v + w_M^2}{2(y + w_M)}\left(\chi^2\right)^{-1}_{\frac{2(y+w_M)^2}{v+w_M^2}}(1-\alpha/2)$$

where y is the age-adjusted death rate, v is the variance as calculated as shown below, w_M is the maximum of the weights $s_i P_i$, $1-\alpha$ is the confidence level desired (e.g., for 95% confidence intervals, α = 0.05), and $\left(\chi^2\right)^{-1}_x$ is the inverse of the χ^2 distribution with x degrees of freedom.

$$v = \sum_{i=1}^{m} d_i\left(s_i/P_i\right)^2$$

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Appendix B: Sources of Additional Information

For more information on cancer, risk factors or prevention strategies please refer to the following resources:

1-800-4CANCER: A cancer information service of the National Cancer Institute

American Cancer Society, Western-Pacific Division: 1-800-729-1151 ext. 3307
American Cancer Society. 1998 Cancer Facts and Figures
American Cancer Society website, http://www.cancer.org/frames.html

National Cancer Institute. PDQ Detection and Prevention Website
http://icicc.nci.nih.gov/clinpdq/screening.html

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Fred Hutchinson Cancer Research Center website: http://www.fhcrc.org/science

American College of Surgeons National Cancer Database website: http://www.facs.org

National Program of Cancer Registries website: http://www.cdc.gov/cancer/index.htm

Appendix C: Advisory Council Members

Teresa Busch, CTR	Washington State Tumor Registrars Association
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